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OEDOGONIUM IN THE VICINITY OF WOODS HOLE, MASSACHUSETTS¹

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(Plates 286-288)

THE present investigation deals with the genus *Oedogonium* as represented in collections from Woods Hole and its vicinity in Barnstable County, southeastern Massachusetts, assembled from 1931 to 1933, mostly by Miss Hannah T. Croasdale and the writer, but a few by Professors W. R. Taylor and G. W. Prescott, and Mr. M. W. Bosworth. To date, the writer has noted fifty species, varieties, and forms, of which eleven are new and forty are previously known kinds.

This paper includes detailed descriptions and drawings of the new forms only, but points out some characteristics of the known species which either have not been described completely or exhibit some divergences from the typical forms.

The stations which have yielded fruiting *Oedogonia* to the writer, may be listed as follows:

1. Silver Beach Pond, West Falmouth.
2. Long Pond, East Falmouth.
3. Weeks' Pond (Main Street), Salt Pond, Fresh Pond, and "Chara Pond"² (all Shore Road), in and near Falmouth.

¹ Papers from the Department of Botany and Herbarium of the University of Michigan, No. 448. Published with aid to RHODORA from the National Academy of Sciences.

² The names in quotation marks pertain to ponds too small or too isolated to have generally known or authentic names. They are either local designations or arbitrary names adopted by workers at the Marine Biological Laboratory. It is expected that a more precise localization and description will accompany a catalog of the fresh-water algae being compiled by Miss H. T. Croasdale.

4. "Harper Pond" (Whitman Road), "Wood Pond" (Ganset Road at Whitman Road), "Endicott Hollow," "Endicott Mire" (Endicott Road), and Iron Pond, in Woods Hole.

5. "Wall Pond," "Stone Wall Pond," "Sheep Pen Pond," "Deer Pond," "Center Pond," and Fawn Pond, on Nonamesset Island, like the following, in the Elizabeth Island chain off Woods Hole.

6. "Dune Pond," on Nashawena Island.

7. "Pasque O," "Pasque K," and "Pasque J," small ponds on Pasque Island.

8. "Sheep Pond," Barmer Pond, "Club House Pond," "Juncus Pond," and "Juncus Pool," on Cuttyhunk Island.

9. A small swamp on Buck Island, between Nonamesset and Naushon Islands.

10. A pond on Naushon Island.

1. *OEDOGONIUM ACMANDRIUM* Elfving. Wall Pond, Aug. 1, 1933 (*Croasdale*); Aug. 17, 1933 (*Jao*).

2. *OEDOGONIUM ACROSPORUM* De Bary. Juncus Pond, June 28, and Sept. 1, 1932, Harper Pond, June 26, 1931 and July 3, 1933, and Weeks' Pond, Aug. 10, 1931 (*Croasdale*); Wall Pond, July 5, and Aug. 17, 1933 (*Croasdale & Jao*).

This species was also reported from Grew's Pond, Falmouth, July 20, 1895, by C. P. Nott in Collins, Holden and Setchell, *Phycotheca Boreali-Americana* No. 163.

3. *OEDOGONIUM ACROSPORUM* De Bary var. *BATHMIDOSPORUM* (Nordstedt) Hirn. Wall Pond, Aug. 1, 1933 (*Croasdale*); Aug. 17, 1933 (*Jao*).

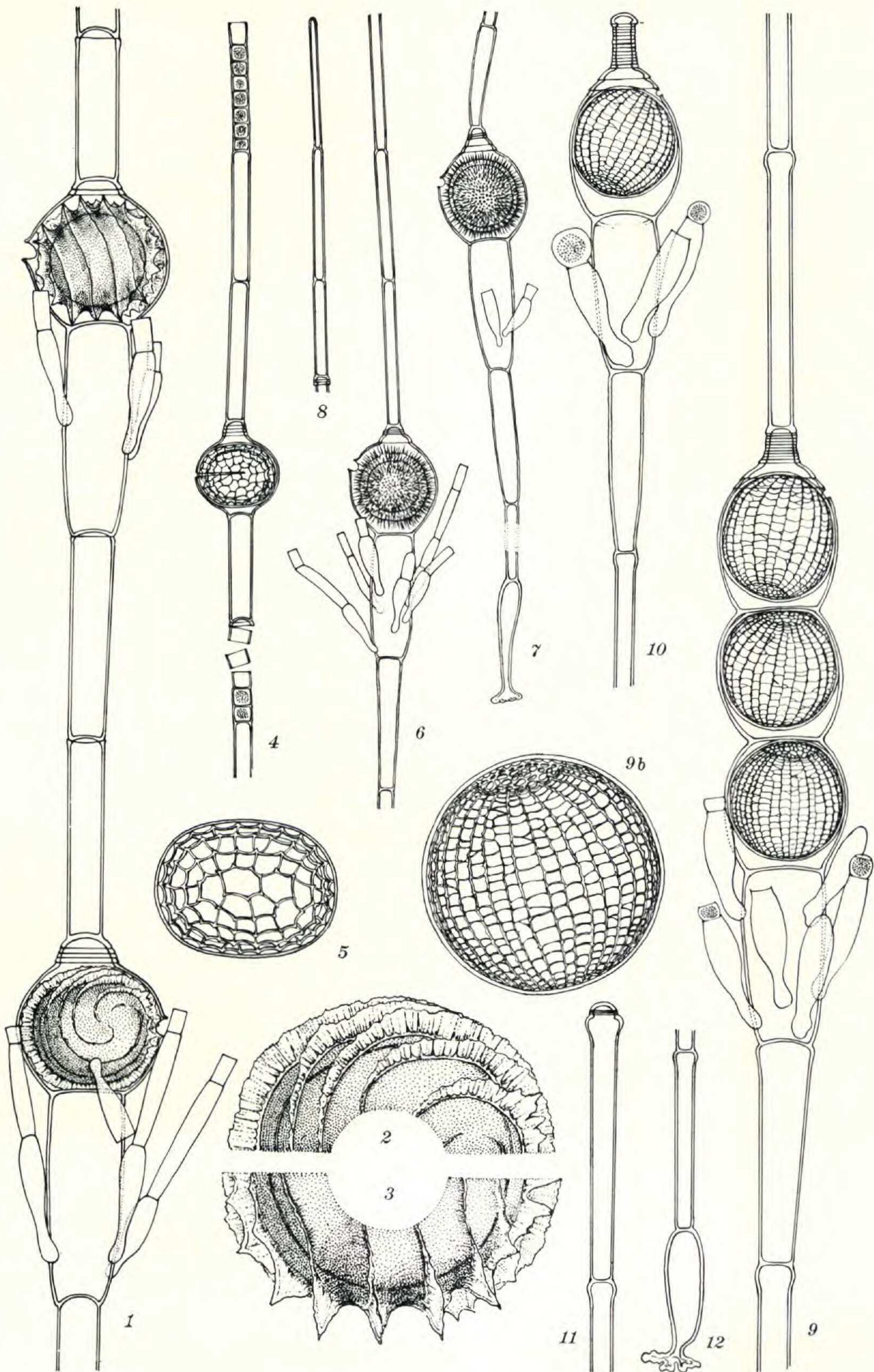
4. *OEDOGONIUM ARESCHOUGHII* Wittrock var. *AMERICANUM* Tiffany.

Two forms were noted. The first is not exactly like Tiffany's variety, in that the samples show a gynandrosporous habit, lesser dimensions of vegetative cells, and shorter basal cells. Professor Tiffany has suggested to the writer that this variety may be both gynandrosporous and idioandrosporous, and in the other characters also may vary into the range of the Woods Hole material. Full data of the local form are:

Vegetative cells	6.4–9.6 μ diam.,	23.0–78.4 μ long.
Oogonia	29.0–38.4 μ diam.,	25.6–41.6 μ long.
Oospores	21.0–28.8 μ diam.,	19.2–24.0 μ long.
Androsporangia	8.0–9.6 μ diam.,	28.8–30.0 μ long.
Antheridia	6.4 μ diam.,	6.4–8.0 (–9.6) μ long.
Basal cells	9.6–10.0 μ diam.,	28.8–30.0 μ long.

This form was collected in Juncus Pond, Aug. 5, 1933 (*Jao*).

The second form of this plant is idioandrosporous in habit and the dimensions of all portions agree closely with Tiffany's diagnosis, but the vegetative cells are rather shorter, commonly less than 25 μ and the greatest length in only a very few cells reaches 61 μ .



OEDOGONIUM SPIRIPENNATUM, figs. 1-3; Oe. CYMATOSPORUM var. AREOLIFERUM, figs. 4 and 5; Oe. HYSTRICINUM var. EXCENTRIPORUM, figs. 6-8; Oe. TAYLORII, figs. 9-12.

This form was collected in a small pond on Pasque Island, July 7, 1933 (*Bosworth*).

5. OEDOGONIUM ARESCHOUGII Wittrock var. **contortifilum**, var. nov. (TAB. 287, FIGS. 22-25). Oedogonium dioicum, nannandrium, gynandrosporum; oogoniis 2- vel 7-continuis vel singulis, depresso-globosis, raro subpyriformi-globosis, operculo mediano apertis, circumscissione latere altero lata, altero angusta; oosporis oogoniis conformantibus et lumen complentibus, vel raro partes polares non complentibus, membrana laevi; androsporangiiis 1- vel 3(-?) -cellulis plerumque curvatis, subepigynis, raro subhypogynis vel dispersis; nannandribus oboviformibus, unicellulis, in oogoniis sedentibus; cellulis vegetativis capitellatis; saepe ea supra oogonium posita atque cellulis filamenti aliquot aliis curvatis vel spiralibus; cellula basali tumida, brevior quam aliis cellulis vegetativis, raro ad 64 μ longa; cellula terminali apice obtusa.

Cell. veg.	7.5-12 μ diam.,	30-65 μ long.
Oogonia	30.0-33 μ diam.,	26-30 μ long.
Oosporae	26.0-30 μ diam.,	24-26 μ long.
Androsporangia	7.0- 8 μ diam.,	6-12 μ long.
Nannandres	5.0- 7 μ diam.,	9-12 μ long.
Cell. basales	9.6-16 μ diam.,	26-32 μ long.

Dioecious, nannandrous, gynandrosporous; oogonia 1-7, depressed-globose, rarely subpyriform-globose, operculate, division median, one side wide, oospore of same form as the oogonium and filling it, or rarely not filling it longitudinally; spore wall smooth; androsporangia 1-3 (-?), generally curved, subepigynous rarely subhypogynous or scattered; dwarf male obovoid, unicellular, on the oogonium; vegetative cells capitellate, as a rule, the first vegetative cell above the oogonium and some portions of the filament curved or spiral in form; the basal cell enlarged and shorter than the vegetative cell, rarely elongate to 64 μ long; terminal cell apically obtuse.

Weeks' Pond, Aug. 10, 1931, Center Pond, Aug. 12, 1931, Harper Pond, July 3, 1933, and Juncus Pond, Aug. 5, 1933 (*Croasdale*); Harper Pond, Aug. 27, 1933 (*Jao*). TYPES in the writer's collections and Herb. Univ. Mich., Woods Hole Nos. 43, 87, and 89.

The variety differs from the type and other varieties or forms chiefly by its curved to spiral filaments.

6. OEDOGONIUM AUTUMNALE Wittrock. Endicott Mire, Aug. 5, 1933 (*Jao*).

7. OEDOGONIUM BOREALE Hirn var. **americanum** var. nov. (TAB. 287, FIGS. 16-18). Oedogonium dioicum, nannandrium, idioandrosporum; oogoniis singulis vel 2- vel 4-continuis, frequenter terminalibus vel inter cellulas vegetativas sparsis, depresso-globosis vel late pyriformibus, membrana usque ad 5 μ crassitudine et lamellosa, solum in medio meridionaliter undulato-plicatis, operculo apertis, circum-

scissione lata, supra medium, margine paullulum undulato; oosporis subdepresso-globosis vel globosis, oogonia complentibus vel fere complentibus, membrana laevi; cellulis suffultoriis interdum tumidis, majoribus 25.6 μ ; filamentis androsporangii paullulum gracilioribus quam femineis, androsporangii singulis vel 2- vel 6-cellulis, interdum tumidis; nannandribus unicellulis, late oboviformibus, in oogonia positis; cellulis vegetativis capitellatis, inferioribus gracilioribus quam superioribus; cellula terminali apice obtusa, saepe substitutione oogonii aut androsporangii nulla; cellula basali tumida, non elongata.

Cell. veg. plant. fem.	12.8–19.2 (–22.4) μ diam.,	32.0–70.4 μ long.
Cell. veg. plant. androsp.	12.8–19.2 μ diam.,	35.2–81.6 μ long.
Oogonia	41.6–54.4 μ diam.,	38.4–54.4 μ long.
Oosporae	33.6–41.6 μ diam.,	32.0–40.0 μ long.
Androsporangia	12.8–16.0 μ diam.,	12.8–19.2 μ long.
Nannandres	8.0–12.8 μ diam.,	9.6–12.8 μ long.
Cellulae basales	19.2–22.4 μ diam.,	32.0–57.6 μ long.

Dioecious, nannandrous, idioandrosporous; oogonia 1–4, scattered or more often terminal, depressed-globose to broadly pyriform, wall up to 5 μ thick and lamellose, with 16–22 longitudinally median folds, operculate, division suprmedian and wide, margin slightly undulated; oospore subdepressed-globose, nearly or not filling the oogonium, spore wall smooth; suffultory cell sometimes tumid, reaching a diameter of 25.6 μ ; androsporangial plant slightly more slender than the female, androsporangia 1–6, often terminal; dwarf male unicellular, broadly obovoid, situated on the oogonium; vegetative cell capitellate, lower cells generally more slender than the upper; terminal cell apically obtuse, often an oogonium of androsporangium; basal cell enlarged, not elongated.

Pasque J Pond, July 19, 1932 (*Croasdale*). TYPES in the writer's collections and Herb. Univ. Mich., Woods Hole Nos. 107: 1, 2, and 3.

The species *Oe. boreale* was discovered in Finland by K. E. Hirn, 1900. It is characterized by its large dimensions, thick- and lamellose-walled oogonium. The number of the folds of the oogonium distinguishes it from its nearest relatives, *Oe. megaporum* Wittrock and *Oe. oelandicum* Wittrock & Hirn. In Hirn's description the idioandrosporous habit is given as doubtful, the oogonium is solitary, rarely two, and the folds are from 16 to 19. This new variety is closely related to *Oe. boreale*, but clearly differs from it in having smaller dimensions of all cells, especially the reproductive cells, and the folds as many as 22 in number.

8. OEDOGONIUM BORISIANUM (Le Clerc) Wittrock. In a swamp on Buck Island, July 24, 1921 (*Taylor* in Herb. Taylor No. 3658); Harper Pond, June 26, 1931, July 3, and July 26, 1933 (*Croasdale*), and Aug. 17, 1933 (*Jao*); Wood Pond, Aug. 29, 1931, and Endicott Hollow, Aug. 5, 1933 (*Croasdale*).

The samples in Professor Taylor's Herbarium are nearly pure and very abundant. Dimensions of the vegetative cells are very variable either on different individuals or on same plant. Generally, the upper cells are broader (to 35.2 μ) and shorter than the lower. In each collection two types of basal cells were noted, namely one form slightly tumid and elongate and the other more enlarged and shortened.

9. *OEDOGONIUM BOSCHII* (Le Clerc) Wittrock. In a small pond on Pasque Island, July 7, 1933 (*Bosworth*).

10. *OEDOGONIUM BOSCHII* (Le Clerc) Wittrock var. *OCCIDENTALE* Hirn. Weeks' Pond, Aug. 10, 1931, and Juncus Pond, Aug. 5, 1933, (*Croasdale*); Wall Pond, Aug. 1, and Aug. 8, 1933 (*Croasdale & Jao*).

11. *OEDOGONIUM CILIATUM* (Hassall) Pringsheim. In the writer's samples, the oogonia were usually solitary, rarely two together, division of the operculum was generally nearly supreme, the androsporangia were usually two, and the vegetative cell was small (8–16.4 μ diam., 48–86.4 μ long). This plant was always very short, the whole filament usually less than ten cells in length.

Wall Pond, June 10, and July 5, 1933 (*Croasdale*); Aug. 17, 1933 (*Jao*).

12. *OEDOGONIUM CONCATENATUM* (Hassall) Wittrock. The local plants have ellipsoid, subobovoid-globose, or globose oospores, with the longitudinally arranged pits in about 40–62 series, the suffultory cell and its adjunct vegetative cells curved. The antheridia show alternate unequal development of opposite sides, giving the antheridial series a wavy form. They form two sperms by horizontal division. The dimensions of all cells are a little smaller than those of the typical plant, except that the vegetative cells are shorter and slightly broader. Otherwise this material was like the type. Full data of the local form are listed:

Vegetative cells	25.6–44.8 μ diam.,	64.0–160.0 μ long.
Oogonia	64.0–76.8 μ diam.,	70.4–112.0 μ long.
Oospores	57.6–73.6 μ diam.,	64.0–83.2 μ long.
Suffultory cells	51.2–60.8 μ diam.,	115.2–134.4 μ long.
Androsporangia	27.2–32.0 μ diam.,	12.8–32.0 μ long.
Male stipes	16.0–22.4 μ diam.,	52.8–64.0 μ long.
Antheridia	9.6–12.8 μ diam.,	11.2–22.4 μ long.

Endicott Mire, Aug. 5, 1933 (*Croasdale*).

13. *OEDOGONIUM CRASSIUSCULUM* Wittrock var. *IDIOANDROSPORUM* Nordstedt & Wittrock. Club House Pond, June 28, 1932 (*Croasdale*); Barmer Pond, June 27, 1933 (*Jao*). The specimens collected in Barmer Pond have smaller dimensions of all cells and the oogonium very rarely is angular-globose in form. Full data of the form are:

Vegetative cells	19.0–30 μ diam.,	60–103 μ long.
Oogonia	42.0–54 μ diam.,	45–60 μ long.
Oospores	38.0–52 μ diam.,	41–52 μ long.
Androsporangia	20.0–26 μ diam.,	10–26 μ long.

Male stipes 9.5–15 μ diam., 52–62 μ long.
 Antheridia 7.0–9 μ diam., 10–16 μ long.

14. *OEDOGONIUM CRENULATOCOSTATUM* Wittrock forma *CYLINDRICUM* Hirn. Harper Pond, July 3, 1933 (*Croasdale*) and Aug. 17, 1933 (*Jao*).

15. *OEDOGONIUM CRENULATOCOSTATUM* Wittrock var. *LONGIARTICULATUM* Hansgirg. Harper Pond, Aug. 17, 1933 (*Jao*).

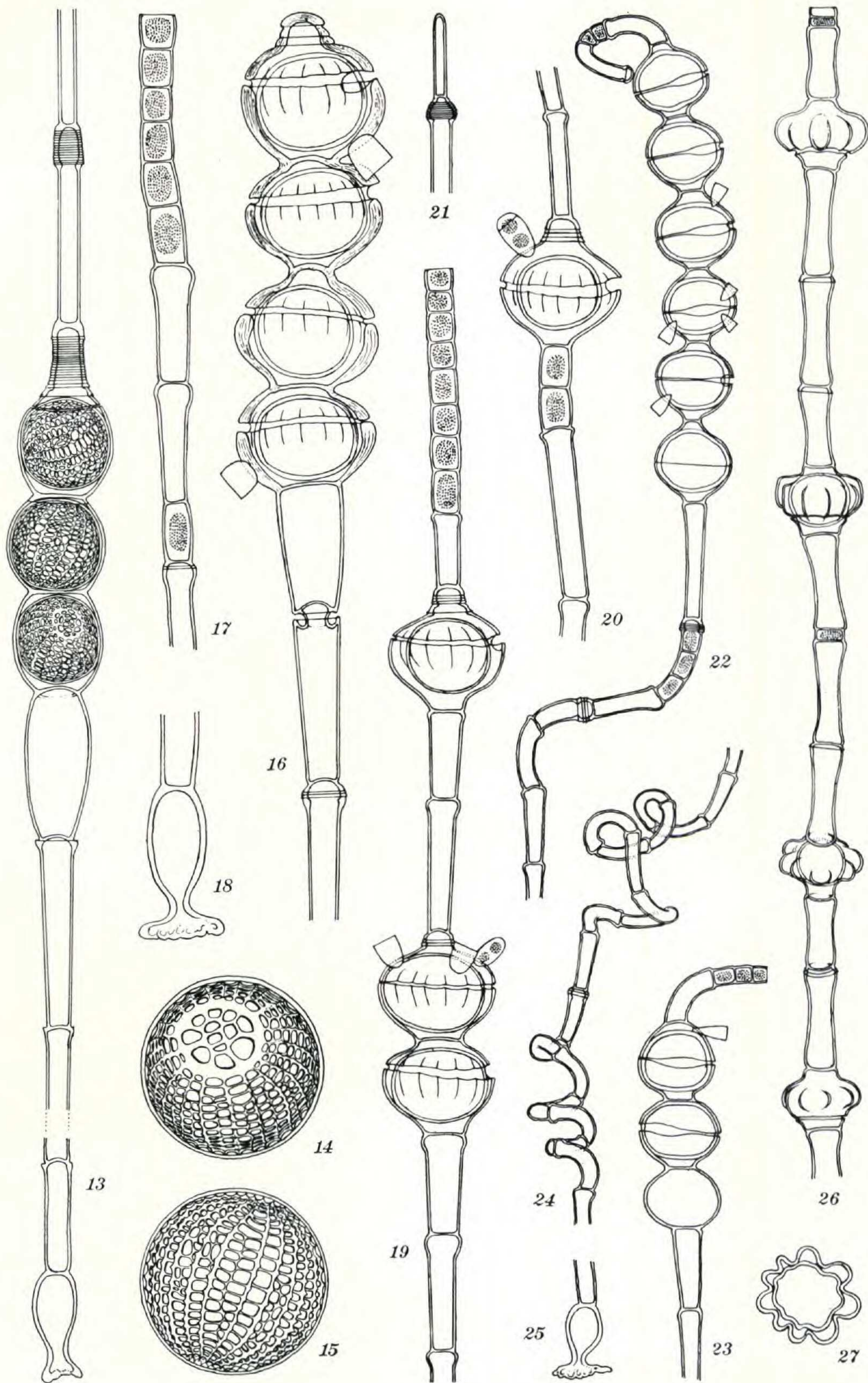
16. *OEDOGONIUM CRISPUM* (Hassall) Wittrock var. *GRACILESCENS* Wittrock. Sheep Pen Pond, June 11, 1932, Pasque O Pond, June 7, 1932, Iron Pond, June 26, 1933, Wall Pond, July 5, 1933 (*Croasdale*); Pasque K Pond and another small pond on the same island, June 7, 1933 (*Bosworth*).

17. *OEDOGONIUM CRISPUM* (Hassall) Wittrock var. *URUGUYAYENSE* Magnus & Wille. Weeks' Pond, June 28, 1932 (*Croasdale*).

18. ***Oedogonium Croasdaleae***, sp. nov. (TAB. 288, FIGS. 31–35). *Oedogonium* dioicum, nannandrium, gynandrosporum; oogoniis singulis vel bis vel septies continuis, plerumque in parte filamenti superiore positis, quadrangulari-ellipsoideis vel suboboviformibus vel subellipsoideis, operculo apertis, circumscissione superiore, interdum lata; oosporis oogoniis conformantibus et lumen plane vel raro subtus vix complentibus, membrana triplici, episporio extus laevi, mesosporio crasso et lamelloso longitudinaliter costato (in sectione optica transversaliter undulato), costis anastomosantibus, irregulariter undulato, in medio oosporae circa 16–30; endosporio granulato; cellulis suffultoriis tumidis; androsporangiiis saepe 8-seriatis, epigynis, raro hypogynis vel subhypogynis; nannandribus cyathiformibus, curvatis, in cellulis suffultoriis vel raro in oogoniis sedentibus, retinaculo irregulariter lobato; antheridiis singulis, interioribus; inferioribus cellulis vegetativis gracilioribus quam superioribus; cellula terminali obtusa saepe a oogonio aut a androsporangio supposita; cellula basali interdum paullulum tumida, retinaculo lobato praedita. Oogonium interdum deest, saepe ab androsporangiiis suppositum, sed in filamentis iis absentia oogonii abnormalibus sunt cellulae suffultoriae atque nannandres semper normaliter positi.

Cell. veg. 20–30 μ diam., 95.0–230.0 μ long.
 Oogonia 56–77 μ diam., 80.0–116.0 μ long.
 Oosporae 54–73 μ diam., 77.0–105.0 μ long.
 Cell. suffultoriae 39–72 μ diam., 70.0–147.0 μ long.
 Androsporangia 10–55 μ diam., 6.4–76.8 μ long.
 Nannandres 10–15 μ diam., 55.0–63.0 μ long.

Dioecious, nannandrous, gynandrosporous; oogonia 1–7, generally on the upper portion of the filament, quadrangular-ellipsoid, subobovoid, or subellipsoid, operculate, division superior, sometimes wide; oospore of the same form as the oogonium and filling it, rarely not reaching the lower end, spore membrane of three layers: outer layer smooth, median layer thick and lamellose, with 16–30 anastomosing, irregularly undulate, longitudinal ribs, inner layer granulate;



OEDOGONIUM RETICULOCOSTATUM, figs. 13-15; Oe. BOREALE var. AMERICANUM, figs. 16-18; Oe. OELANDICUM var. NOVAE-ANGLIAE, figs. 19-21; Oe. ARESCHOUGHII var. CONTORTIFILUM, figs. 22-25; Oe. PLATYGYNUM var. AMBI-CEPS, figs. 26 and 27.

suffultory cell tumid; androsporangia to 8-seriate, epigynous, rarely hypogynous or subhypogynous; dwarf male goblet-shaped, curved, on the suffultory cell, occasionally on the oogonium, holdfast irregularly lobed, antheridium 1, interior; filaments tapering toward the base; terminal cell obtuse, often an oogonium or androsporangium; basal cell sometimes a little swollen, with a lobed holdfast. Oogonium occasionally absent or poorly developed, often replaced by androsporangia, but the suffultory cell and dwarf males in their usual positions.

This is the only known species which is characterized by a granulate inner spore wall, and also the only nannandrous member of the genus possessing a gynandrosporous habit, superior operculum, longitudinally ribbed oospores, and interior antheridia. It bears some resemblance to *Oe. michiganense* Tiffany. It differs, however, in having larger dimensions, the vegetative cells not being capitellate, in having quadrangular-ellipsoid, subobovoid, or subellipsoid oogonia and oospores, with a larger number of ribs, and granulate inner spore-wall. It also looks like members of the "cyathigerum" and "Wolleanum" group. It is distinguished clearly by its operculate character and granulate inner spore-wall.

Harper Pond, June 26 and Aug. 10, 1931, and July 3, 1933 (*Croasdale*) and Aug. 27, 1933 (*Jao*); Wood Pond, Aug. 10 and 29, 1931, Wall Pond July 7, 1932, and Pasque J Pond, July 19, 1932 (*Croasdale*). TYPES in the writer's collections and Herb. Univ. Mich., Woods Hole Nos. 40-45 and 87.

19. OEDOGONIUM CRYPTOPORUM Wittrock. Salt Pond, Aug. 11, 1931 (*Croasdale*); Chara Pond, July 23, 1933 (*Jao*); Pasque K Pond, July 7, 1933 (*Bosworth*); a pond on Naushon Island, July 17, 1917 (*Taylor*, in Herb. Taylor, No. 2565).

20. OEDOGONIUM CRYPTOPORUM var. VULGARE Wittrock. Stone Wall Pond, June 11, 1932, Iron Pond, June 26, 1933, Harper Pond, July 3, 1933, and Juncus Pond, Aug. 5, 1933 (*Croasdale*); Wall Pond, Aug. 17, 1933 (*Jao*); a pond on Naushon Island, July 17, 1917 (*Taylor* in Herb. Taylor, No. 2565).

The dimensions of the Wall Pond specimens are rather larger than those of the plants which were collected from other localities.

21. OEDOGONIUM CYMATOSPORUM Hirn var. **areoliferum**, var. nov. (TAB. 286, FIGS. 4, 5). Oedogonium monoicum; oogoniis singulis, depresso-globosis, poro mediano rimiformi apertis; oosporis forma oogoniis similibus et ea complementibus, membrana triplici; episporio et endosporio laevi, mesosporio areolato (in sectione optica undulato); antheridiis 4- vel 7-cellularibus, subepigynis, subhypogynis vel dispersis; spermatozoidiis singulis; cellula terminali obtusa.

Cell. veg.	6.4– 9.6 μ diam.,	25.6–64.0 μ long.
Oogonia	28.8–32.0 μ diam.,	25.6–41.0 μ long.
Oosporae	25.6–28.8 μ diam.,	19.2–25.6 μ long.
Antheridia	6.4– 9.6 μ diam.,	6.4– 9.6 (–12.8) μ long.

Monoecious; oogonium solitary, depressed globose, pore median, rimiform; oospore similar in form to the oogonium and filling it, the spore wall of three layers: the outer and inner smooth, the middle areolate; antheridia 4–7, subepigynous, subhypogynous or scattered; sperm single; terminal cell obtuse.

This variety shows some characteristics of *Oe. cymatosporum* Wittrock & Nordstedt, but is distinguished chiefly by its areolate median spore wall, constantly depressed-globose oogonia and oospores, and smaller dimensions of the fruiting cells. The illustration given by Hirn shows a foveolate rather than an areolate spore wall, and Tiffany's figure conforms. In the familiar species of this genus which are characterized by monoecious habit and a median rimiform pore, no areolate spore types have previously been found. The only monoecious representatives of the genus with reticulate oospores are *Oe. dictyosporum* Wittrock and its forma *Westii* Tiffany. This new variety is distinguished from these in having the pore median, fruiting cells depressed, an areolate median spore-wall, and lesser dimensions.

Wall Pond, June 10, and July 5, 1933 (*Croasdale*); Aug. 17, 1933 (*Jao*). TYPES in the writer's collections and Herb. Univ. Mich., Woods Hole Nos. 67, 68, 90, and 91.

22. OEDOGONIUM ECHINOSPERMUM Braun. Wall Pond, Aug. 1, 1933, (*Croasdale*); Aug. 17, 1933 (*Jao*).

23. OEDOGONIUM ELEGANS West & West var. **americanum**, var. nov. (TAB. 288, FIGS. 28–30). Oedogonium dioicum, nannandrium, gynandrosporium vel (?) idioandrosporium; oogoniis singulis operculo apertis, circumscissione medianis; oosporis depresso-globosis, oogonia complentibus; membrana laevi; androsporangiis 1–2, subhypogynis vel sparsis, paullulum tumidis; spermatozoidiis singulis; cellulis vegetativis, androsporangiis, et oogoniis dense et minute granulatis, granulis spiraliter dispositis; cellulis vegetativis expanse capitellatis; cellula terminali apice obtusa; cellula basali subhemisphaerica vel depresso-globosa; membrana verticaliter plicata.

Cell. veg.	4.8– 8.0 μ diam.,	25.6–67.8 μ long.
Oogonia	27.2–32.0 μ diam.,	24.0–27.2 μ long.
Oosporae	20.8–28.8 μ diam.,	19.2 μ long.
Androsporangia	8.0– 9.6 μ diam.,	9.6–12.8 μ long.
Cell. basalis	14.4–17.0 μ diam.,	11.5–13.0 μ long.

Dioecious, nannandrous, gynandrosporous or idioandrosporous (?); oogonium solitary, depressed-globose, operculate, division median; oospore depressed-globose, filling the oogonium or not, spore-wall

smooth; androsporangia 1–2, subhypogynous or scattered, generally a little tumid; vegetative cells, oogonis, and androsporangia densely and minutely granulate, the granules spirally arranged; vegetative cells broadly capitellate; terminal cell apically obtuse; basal cell sub-hemispherical to depressed-globose; wall vertically plicate.

The species *Oe. elegans* is found only in Ceylon as reported by West. In the description and drawings only the vegetative cells are marked by minute granules and the capitellate character of the vegetative cells was not pointed out, though suggested by the slight lateral swelling of a few cells in his figures. This variety is clearly characterized by its broadly capitellate vegetative cells and the granulate oogonia, androsporangia, and vegetative cells.

Salt Pond, Aug. 11, 1931 (*Croasdale*). TYPES in the writer's collections and Herb. Univ. Mich., Woods Hole Nos. 108: 1 — 5.

24. OEDOGONIUM GLOBOSUM Nordstedt. Salt Pond, Aug. 11, 1931, (*Croasdale*).

25. OEDOGONIUM GRANDE Kuetzing & Wittrock. This is one of the most common Oedogonia occurring in the region. Fresh Pond, Sept. 1, 1929, (in Herb. Taylor No. 15037); Stone Wall Pond, June 11, 1932, Harper Pond, June 26, and July 29, 1931 and July 26, 1933, Club House Pond, June 11, 1932, Wall Pond, July 7, 1932, and Endicott Hollow, Aug. 26, 1933, (*Croasdale*); Sheep Pond, June 27, and Harper Pond, Aug. 17, 1933, (*Jao*). This species was also reported from Long Pond, Falmouth, July 1895, by C. P. Cott, in Collins, Holden and Setchell: *Phycotheca Boreali-Ameridana* No. 519.

26. OEDOGONIUM GRANDE Kuetzing & Wittrock var. ANGUSTUM Hirn. Harper Pond, July 3, 1933, Stone Wall Pond, July 7, 1933, and Endicott Hollow, Aug. 5, 1933 (*Croasdale*); Harper Pond, Aug. 17, 1933, (*Jao*).

27. OEDOGONIUM HYSTRICINUM Transeau & Tiffany var. **excentriporum**, var. nov. (TAB. 286, FIGS. 6–8). Oedogonium dioicum, nannandrium, (?) idioandrosporum; oogonio solitario, oboviformiglobo, poro supra medium aperto; oosporis subglobosis vel globosis, oogonia complentibus, raro vix complentibus, membrana triplici: mesosporio et endosporio laevi, episporio dense echinato; cellulis suffultoriis tumidis; nannandribus paullulum curvatis, in cellulis suffultoriis sedentibus, stipite interdum bi- vel tricellulari; cellula basali interdum subtumida non elongata; cellula terminali obtusa.

Cell. veg.	6.0– 8.0 μ diam.,	40.0–94 μ long.
Oogonia	22.0–35.0 μ diam.,	38.0–48 μ long.
Oosporae (C. echin.)	27.0–32.0 μ diam.,	32.0–35 μ long.
Cell. suffultoriae	12.0–19.5 μ diam.,	47.0–54 μ long.
Nannadrium stipes		
Cell. inferior	5.0– 6.5 μ diam.,	10.0–21 μ long.
Cell. superior	3.5– 6.5 μ diam.,	9.5–26 μ long.
Cell antherid	5.0– 6.0 μ diam.,	5.0–12 μ long.

Dioecious, nannandrous, (idioandrosporous ?); oogonium solitary, obovoid-globose, pore supramedian, oospore subglobose to globose, filling the oogonium, rarely nearly filling it, spore-wall of three layers: median and inner layers smooth, outer layer densely echinate; suffultory cell swollen; dwarf male slightly curved, on the suffultory cell, stipe 1- to 3-celled; antheridium 1, exterior; basal cell sometimes a little tumid, not elongate; terminal cell obtuse.

This variety distinctly belongs to *Oe. hystricinum* Transeau & Tiffany in having the densely echinate oospore and swollen suffultory cell, but is clearly differentiated from the type, by the smaller dimensions of its vegetative cells, pore not median, male stipes 1- to 3-celled, and basal cell not elongated.

Harper Pond, June 3, 1933 (*Croasdale*) and Aug. 17, 1933, (*Jao*). TYPES in the writer's collections and Herb. Univ. Mich., Woods Hole Nos. 43 and 47.

28. OEDOGONIUM INTERMEDIUM Wittrock. Wood Pond, Aug. 10, 1931 and Salt Pond, Aug. 11, 1931 (*Croasdale*).

29. OEDOGONIUM INVERSUM Wittrock. Deer Pond, July 7, 1932 (*Croasdale*); Chara Pond, June 23, 1933 (*Jao*); a pond on Naushon Island, July 17, 1917 (*Taylor* in Herb. Taylor No. 2565).

30. OEDOGONIUM MACRANDIUM Wittrock var. PROPINQUUM (Wittrock) Hirn. Long Pond, June 14, 1933 (*Croasdale*).

31. OEDOGONIUM MAMMIFERUM Wittrock & Nordstedt. Sheep Pen Pond, July 5, 1931, Deer Pond, July 7, and Sept. 11, 1932, and Wall Pond, June 5, 1933 (*Croasdale*); Chara Pond, June 23, 1933 and Sheep Pond, June 27, 1933 (*Jao*).

32. OEDOGONIUM MINUS Wittrock. The dimensions are a little smaller than those of the typical forms. The oospore sometimes fills the oogonium, and the vegetative cells are distinctly capitellate. The full data are:

Vegetative cells	4.8-12.8 μ diam.,	25.6-84.0 μ long.
Oogonia	32.2-44.8 μ diam.,	35.2-41.6 μ long.
Oospores	28.8-38.4 μ diam.,	22.4-35.2 μ long.
Antheridia	12.0-13.0 μ diam.,	3.2- 9.6 μ long.

Wall Pond, Aug. 17, 1933 (*Jao*).

33. OEDOGONIUM MITRATUM Hirn. Chara Pond, June 22, 1933 (*Jao*).

34. OEDOGONIUM NOBILE Wittrock var. MINUS Hirn. The dimensions of this local form are not exactly like the typical plants with respect to the reproductive cells. The antheridia range up to 6-seriate. The full data are:

Vegetative cells	12.8-22.4 μ diam.,	114.0-173.0 μ long.
Oogonia	57.6-60.8 μ diam.,	96.0- 80.0 μ long.
Oospores	54.4-57.6 μ diam.,	70.4- 73.6 μ long.
Antheridia	16.0-17.6 μ diam.,	6.4- 12.8 μ long.

Endicott Mire, Aug. 5, 1933 (*Croasdale*).

35. *OEDOGONIUM OELANDICUM* Wittrock & Hirn var. **Novae-Angliae**, var. nov. (TAB. 287, FIGS. 19-21). Oedogonium dioicum, nannandrium, gynandrosporum; oogoniis 2- vel 4-continuis vel singulis, depresso-globosis, in medio plicatis, plicis ?-16 aequatorialibus verticillatis, nondum regionem polarem attingentibus, operculo supra medium circumciso, margine undulata; oosporis oogoniis conformantibus et lumen plane complentibus, raro (praecipue longitudinaliter) non complentibus, membrana laevi; cellulis suffultoriis saepe tumidis; androsporangiiis 2- vel 7-cellularibus vel unicellularibus, subepigynis, hypogynis, vel sparsis; nannandribus oboviformibus, unicellularibus, in oogoniis sedentibus; spermatozoidiis binis, divisione horizontali natis; cellulis vegetativis capitellatis; cellula basali tumida; cellula terminali apice obtusa, interdum quam cellulis vegetativis tenuiore.

Cell. veg.	9.6-16 μ diam.,	32.5-86.0 μ long.
Oogonia	40.0-51 μ diam.,	33.0-43.2 μ long.
Oosporae	35.0-43 μ diam.,	30.0-36.0 μ long.
Cell. suffult.	13.0-20 μ diam.,	30.0-64.0 μ long.
Androsporangia	11.0-14 μ diam.,	9.0-17.0 μ long.
Nannandres	8.0-10 μ diam.,	9.5-13.0 μ long.

Dioecious, nannandrous, gynandrosporous; oogonia 1-4, depressed-globose, with ?-16 longitudinal median plicae, operculate, division suprmedian, margin undulate; oospore of the same form as the oogonium and filling it, rarely a little shorter and not filling it completely, spore-wall smooth; suffultory cell sometimes tumid; androsporangia 1-7 (-?), subepigynous, hypogynous, or scattered; dwarf male obovoid, unicellular, seated on the oogonium; sperms 2, division horizontal; vegetative cells capitellate; basal cell enlarged; terminal cell apically obtuse, sometimes more slender than the vegetative cells.

This variety is characterized by its large dimensions, especially of the fruiting cells, which serve to distinguish it from the type form of the species and from f. *minus* Børge. It also bears some resemblance to *Oe. megaporum* Wittrock, *Oe. costatum* Transeau, and *Oe. boreale* Hirn. It differs, however, from the first by its larger oogonia and oospores, from the second by the lesser dimensions of its female fruiting cells, the oogonium 1- to 4-seriate, and in that the verticillate folds of the oogonium do not reach to poles, and from the third in having lesser dimensions, and the oogonial wall not thick and lamellose.

Harper Pond, July 3, 1933, and Endicott Mire, Aug. 5, 1933 (*Croasdale*), and by Jao at the first station, Aug. 27, 1933. TYPES in the writer's collections and Herb. Univ. Mich., Woods Hole Nos. 40-50 and 87.

36. *OEDOGONIUM PLATYGYNUM* Wittrock. Silver Beach Pond, Sept. 1, 1933 (*Croasdale*).

37. **OEDOGONIUM PLATYGYNUM** Wittrock var. **ambiceps**, var. nov. (TAB. 287, FIGS. 26, 27). Oedogonium dioicum, nannandrium, gynandrosporum; oogoniis singulis, depresso-globosis, in medio plicis 8-10 verticillatis, elongatis, obtuse rotundatis instructis, operculo apertis, circumscissione infra medium, margine undulata vel recta; oosporis subglobosis vel globosis, interdum depresse lateque costatis, costis brevibus verticillatis; oosporis oogoniis conformantibus, oogonia omnino vel raro vix complentibus (plicationibus oogonii exceptis); membrana laevi; androsporangiiis 1-vel 2-cellularibus, subepigynis vel subhypogynis; cellula vegetativa distincte utrinque capitellata.

Cell. veg.	9.6-12.8 μ diam.,	22.4-41.6 μ long.
Oogonia	32.0-38.4 μ diam.,	22.4-28.8 μ long.
Oosporae	19.2-25.6 μ diam.,	19.2-22.4 μ long.
Androsporangia	11.2-12.8 μ diam.,	3.2 μ long.

Dioecious, nannandrous, gynandrosporous; oogonium solitary, depressed-globose, with 8-10 long rounded projections arranged in a whorl about the middle, operculate, the division inframedian, margin undulate or straight; oospore subglobose to globose, sometimes with low projections like those of the oogonium, quite or rarely nearly filling the oogonium exclusive of the projections, spore-wall smooth; androsporangia 1-2, subepigynous or subhypogynous; vegetative cells distinctly capitellate at both ends.

This variety is characterized chiefly by the large dimensions of its oogonia and oospores and in that its vegetative cells are capitellate at both ends, in these points differing from the type and the other form and variety.

Juncus Pond, Aug. 5, and Wall Pond, June 5, 1933 (*Croasdale*); Wall Pond, Aug. 17, 1933 (*Jao*). TYPES in the writer's collections and Herb. Univ, Mich., Woods Hole Nos. 89-91.

38. **OEDOGONIUM PRATENSE** Transeau. Pasque K Pond, June 7, 1933 (*Bosworth*); Wall Pond, July 5, 1933 (*Croasdale*).

39. **OEDOGONIUM PUSILLUM** Kirchner. Sheep Pen Pond, July 5, 1933 (*Croasdale*).

40. **OEDOGONIUM PUNGENS** Hirn. Weeks' Pond, Aug. 10, 1933 (*Croasdale*).

41. **OEDOGONIUM REINSCHII** Roy. Sheep Pond, June 27, 1933 (*Jao*).

42. **Oedogonium reticulocostatum**, sp. nov. (TAB. 287, FIGS. 13-15). Oedogonium dioicum; oogoniis 2-vel 8-continuis vel singulis, globosis, vel subglobosis, vel suboboviformi-globosis, superne circumscissis, operculo minimo, interdum latiusculo; oosporis globosis, maturitate aurantiacis, oogonia complentibus, interdum longitudinaliter non complentibus, membrana triplici; episporio et endosporio laevi, mesosporio longitudinaliter costato (in sectione optica undulato), costis denticulatis et incrassatis, in medio oosporae 10-22, inter se transverse costulatis, interdum anastomosantibus reticula-

tionem distinctam formantibus, pro parte marginem disci polaris non attingentibus, regione polari reticulata disciformi, axe transverso vel obliquo; cellulis suffultoriis tumidis; cellulis vegetativis paullum capitellatis, cum acutis angulis superioribus; cellula terminali obtusa vel anguste conica; cellula basali tumida. Planta mascula ignota.

Cell. veg.	8.0–16.0 μ diam.,	44.8–86.4	μ long.
Oogonia	(25.8–) 28.8–36.7 μ diam.,	32.0–46.0 (–72)	μ long.
Oosporae	(23–) 27.2–32.0 μ diam.,	27.2–32.0	μ long.
Cell. suffult.	22.4–25.6 μ diam.,	44.8–57.6	μ long.

Dioecious; oogonia 1–8, globose, subglobose, or subobovoid-globose, operculate, division supreme, narrow; oospore globose, orange at maturity, filling the oogonium, except sometimes the length, spore-wall of three layers, the outer and inner smooth, the median layer with 10–22 longitudinal, toothed and thickened ribs, connected by transverse, sometimes anastomosing lines to form coarse reticulations; polar region reticulate, disc-shaped; polar axis transverse or oblique to the axis of filament; ribs in part not reaching the margin of the polar disk; suffultory cell swollen; vegetative cells slightly capitellate the upper angles acute; the terminal cell apically obtuse to sharply conical; the basal cell enlarged. Male plant unknown.

This species is characterized by the supreme position of the operculum, and by the longitudinally toothed ribs which join directly to the margins of the discoid polar areas and are connected by transverse lines to form a reticulum, which serves to distinguish these plants from the group of *O. monile*, to which this species is probably most nearly related.

Collected in a small pond on Pasque Island, July 7, 1933 (*Bosworth*). TYPE in the writer's collections and Herb. Univ. Mich., Woods Hole No. 64.

43. *OEDOGONIUM RUGULOSUM* Nordstedt. Details additional to the description in Tiffany's monograph are: this species is gynandrosporous, androsporangium usually solitary, hypogynous, a little swollen, 6 — 7.5 μ diam., and 10 — 11 μ long, terminal cell apically obtuse, or replaced by an oogonium; the basal cell slightly enlarged; commonly epiphytic on other species of *Oedogonium* or other algae.

Iron Pond, June 26, 1933, Wall Pond, July 19, 1932, and Endicott Mire and Juncus Pond, Aug. 5, 1933 (*Croasdale*); Harper Pond, July 3 and 26, 1933 (*Croasdale and Jao*).

The specimens collected in Harper Pond were slightly larger than those collected from other stations.

44. *OEDOGONIUM SANCTI-THOMAE* Wittrock & Cleve (?). Harper Pond, Aug. 17, 1933 (*Jao*).

45. *OEDOGONIUM SEXANGULARE* Cleve. Salt Pond, Aug. 11, 1931, Weeks' Pond, Aug. 10, 1931, and Harper Pond, June 26, and July 29, 1931 and June 3 and July 26, 1933 (*Croasdale*); Harper Pond, Aug. 17, 1933 (*Jao*).

46. *OEDOGONIUM SEXANGULARE* Cleve var. *MAJUS* Wille. Harper Pond, June 26 and Aug. 29, 1931, June 3 and July 26, 1933 and Iron Pond, June 26, 1933 (*Croasdale*); Harper Pond, Aug. 17, 1933 (*Jao*).

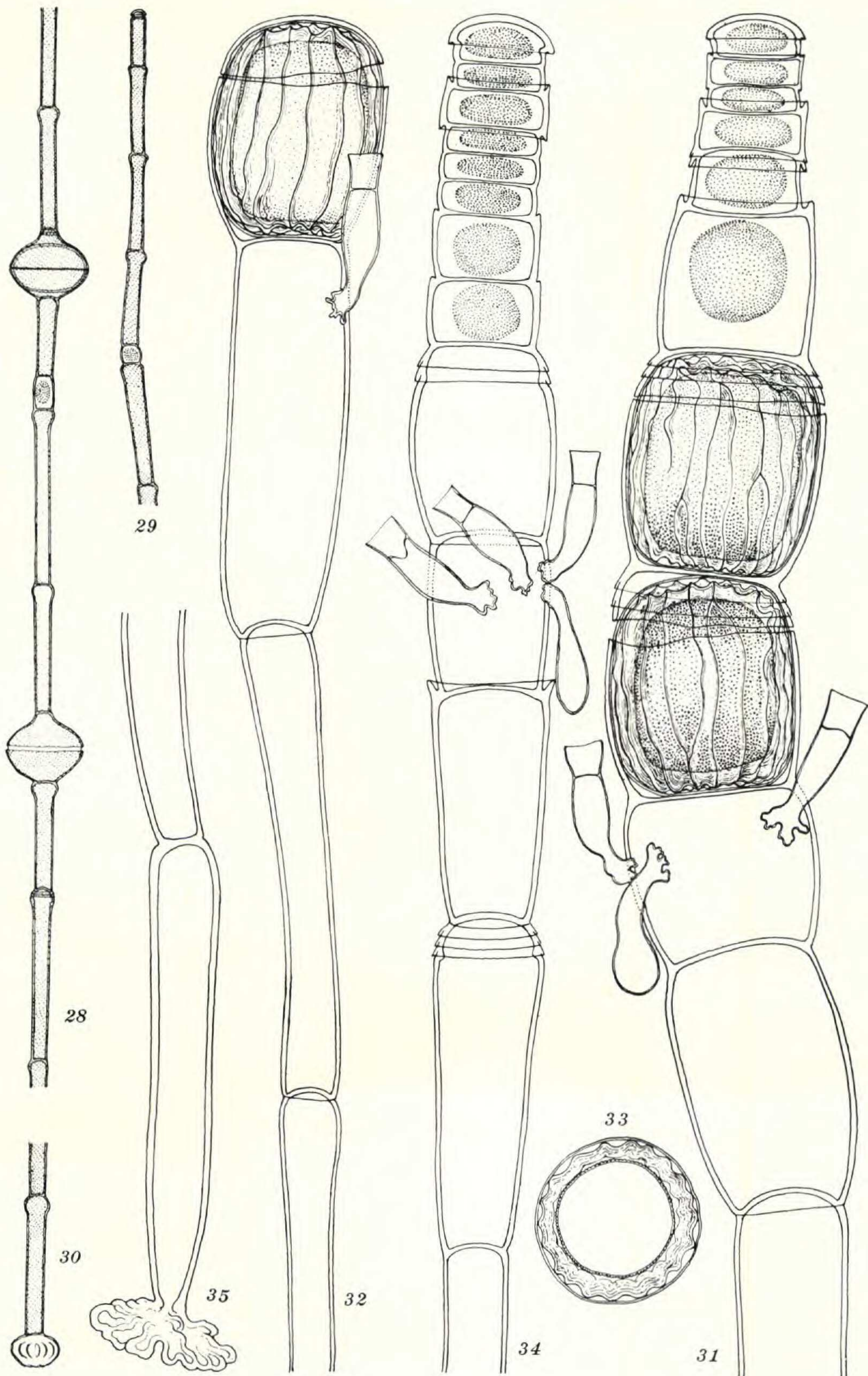
47. *Oedogonium spiripennatum*, sp. nov. (TAB. 286, FIGS. 1-3). *Oedogonium* dioicum, nannandrium, (?) idioandrosporum; oogoniis singulis, subglobosis vel oboviformi-globosis, poro mediano apertis; oosporis globosis vel subglobosis, oogonia complentibus, membrana triplici: episporio subtiliter granulato-costato, costis, 5-7 spiralibus dentatis membranaceo-alatis, ad polos inter se anastomosantibus; axe semper transversali; cellulis suffultoriis tumidis; nannandribus paululum curvatis, in cellulis suffultoriis sedentibus, stipite 1- vel 2-cellulari; antheridio exteriori, unicellulari; spermatozoidiis singulis; cellulis vegetativis inferioribus gracilioribus quam superioribus; cellula basali paululum tumida, retinaculo lobato; cellula terminali obtusa.

Cell. veg.	16.0-22.4 μ diam.,	44.8-89.6 μ long.
Oogonia	48.0-57.6 μ diam.,	48.0-61.0 μ long.
Oosporae	44.8-54.4 μ diam.,	41.6-51.2 μ long.
Cell. suffult.	25.6-32.0 μ diam.,	64.0-80.0 μ long.
Nannand. stipes		
Cell. superior	6.4- 8.0 μ diam.,	38.4-48.0 μ long.
Cell. inferior	9.6-12.8 μ diam.,	35.2-44.8 μ long.
Antheridia	6.4- 9.0 μ diam.,	5.0-16.0 μ long.
Cell. basalis	19.2 μ diam.,	60.8 μ long.

Dioecious, nannandrous, idioandrosporous (?); oogonium solitary, subglobose to obovoid-globose, pore median, oospore globose or subglobose, filling the oogonium, spore-wall of three layers: the median and inner smooth, the outer layer finely granulate, with 5 — 7 spiral, toothed, membranous-winged ribs uniting at the poles; the polar axis always placed in a transverse position, never parallel with the filament; the suffultory cell swollen; the dwarf male a little curved, on the suffultory cell, rarely on the oogonium or near by the suffultory cell; stipe cells 1 — 2; antheridium 1, exterior; sperm 1; lower vegetative cells of the filament generally more slender than the upper, but the basal cell slightly enlarged, with a lobed holdfast; terminal cell apically obtuse.

This species is near *Oe. illinoisense* Transeau and *Oe. spiralidens* Jao. It differs, however, from the first in having membranous-winged ribs on a granulate outer spore-wall, the male stipe cells 1 — 2, antheridium 1, vegetative cells larger, and reproductive cells rather smaller, especially the cells of the dwarf male plants, and from the second, in having membranous-winged ribs, male stipe 1- to 2-celled, antheridium 1, and in its larger dimensions.

Wall Pond, June 10 and July 5, 1933 (*Croasdale*); Aug. 17, 1933 (*Jao*). TYPES in the writer's collections and Herb. Univ. Mich., Woods Hole Nos. 67, 68, 90, and 91.



OEDOGONIUM ELEGANS var. *AMERICANUM*, figs. 28-30; *Oe. CROASDALEAE*, figs. 31-35.

48. *OEDOGONIUM SUECICUM* Wittrock. Dune Pond (south), June 24, 1931, Iron Pond, June 26, 1933 (*Croasdale*); Wall Pond, Aug. 17, 1933 (*Jao*). The specimens from Iron Pond are a little smaller than the typical form.

49. *OEDOGONIUM TAPEINOSPORUM* Wittrock. Wall Pond, Aug. 17, 1933 (*Jao*).

50. *Oedogonium Taylorii*, sp. nov. (TAB. 286, FIGS. 9-12). Oedogonium dioicum, nannandrium, idioandrosporum; oogoniis singulis vel 2- vel 3-continuis, globosis vel ellipsoidali-globosis, poro superiore apertis; oosporis globosis, raro subellipsoidali-globosis, oogonia complentibus vel partes polares non complentibus, membrana triplici: episporio etiamque endosporio laevi, mesosporio longitudinaliter costato (in sectione optica transversaliter undulato), costis crenulatis vel dentatis, in medio oosporae 22-28, inter se costulis distinctis transversalibus, interdum anastomosantibus conjunctis, costis paucis ad polos non attingentibus, regione polari disciformi et reticulata, axe cum eo filamentum directione fere continente; cellulis suffultoriis tumidis; androsporangiiis 1- vel 4-seriatis, terminalibus; nannandriis in cellulis suffultoriis sedentibus, stipite paullulum curvato, antheridiis exterioribus, unicellulis, globosis, prope apicem operculo dehiscentibus; spermatozoidiis singulis; cellulis vegetativis latiusculis capitellatis; cellula terminali obtusa, in filamentis femineis frequenter substitutione oogonii nulla; cellula basali tumida, retinaculo irregulariter lobato substrato affixa.

Cell. veg.	8.0-19.2 μ diam.,	38.4-112.0 μ long.
Oogonia	35.2-51.2 μ diam.,	46.4- 73.6 μ long.
Oosporae	32.0-46.2 μ diam.,	32.0- 51.2 μ long.
Cell. suffult.	32.0-33.6 μ diam.,	54.4- 73.6 μ long.
Androsp.	16.0-17.6 μ diam.,	16.0- 22.8 μ long.
Stip. nannandr.	9.6-12.8 μ diam.,	48.0- 51.2 μ long.
Antheridia	6.4(-16) μ diam.,	4.8- 6.4 μ long.
Cell. basalis	12.8-19.2 μ diam.,	48.0- 89.6 μ long.

Dioecious, nannandrous, idioandrosporous; oogonia 1-3, globose or ellipsoid-globose, with superior pore; oospore globose, very rarely subellipsoid-globose, partly or completely filling the oogonium, spore-wall of three layers: the outer and inner smooth, the middle with 22-28 crenulate to slightly dentate, longitudinally continuous ribs, connected by transverse, sometimes anastomosing lines, some ribs not continued to the polar regions; polar regions disc-shaped and reticulate in structure, polar axis nearly parallel to the filament; suffultory cell enlarged; androsporangia 1-4 (-?), mostly terminal on the filament; dwarf male a little curved, on the suffultory cell; antheridium 1, exterior, globose, dehiscing by an operculum near the apex; sperm single; vegetative cell capitellate, not very broad; terminal cell obtuse, on the female plant sometimes becoming an oogonium; basal cell enlarged, with an irregularly lobed attachment.

In this genus only *Oe. michiganense* Tiffany is characterized by